



COMPONENT SPECIFICATION

ETM Telescope Lenses

APPROVALS:	DATE	REV	DCN NO	BY	CHK	DCC	DATE
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CHECKED:							
APPROVED:							
DCC RELEASE:							

1 SCOPE

This is a specification for the optical elements the ETM telescope. This device is an afocal, 3-element Galilean 8x beam reducer, which in combination with an optical relay system produces an image of the entrance pupil of the ETM PO telescope on the ISC quad photodetector.

2 APPLICABLE DOCUMENTS

2.1. LIGO Documents

- LIGO-960641-05, Electronic Submissions to the Document Control Center
- LIGO-E960022, Vacuum Compatibility, Cleaning Methods and Compatibility Procedures
- LIGO-E960050, Vacuum Compatible materials list
- LIGO-L970196, Part Numbers and Serialization of Detector Hardware

2.2. Other Documents

- MIL-C-675C, Coating Adhesion and Durability

3 REQUIREMENTS

3.1. PERFORMANCE CHARACTERISTICS

3.1.1. Lens Fabrication

3.1.1.1 Objective Lens (Element 1)

material	BK7
process	conventional polish
surface finish	40-20
surface roughness	<100 Ang.
edge	fine ground
edge bevel	45 deg
index of refraction tolerance	+/- 0.001
radius 1	368.3 +/-3.5



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radius 2	-4494.2 +/- 9.9
wavefront aberration- power	<1 fringe @ 632 nm
wavefront aberration- irregularity	<1/4 fringe @ 632 nm
clear aperture diameter	170.0
edge diameter	176.0, -0.025 +0.0
central thickness	24.0, +/-0.5
wedge	<0.0340 TIR

3.1.1.2 Eyepiece 1 Lens (Element 2)

material	BK7
process	conventional polish
surface finish	40-20
surface roughness	<100 Ang.
edge	fine ground
edge bevel	45 deg
index of refraction tolerance	+/- 0.001
radius 1	78.88 +/- 0.1
radius 2	165.33 +/- 0.2
wavefront aberration- power	<1 fringes @ 632 nm
wavefront aberration- irregularity	<1/4 fringe @ 632 nm
clear aperture diameter	70.0
edge diameter	74.0, -0.025 +0.0
central thickness	15.0, +/-0.2
wedge	<0.070 TIR

3.1.1.3 Eyepiece 2 Lens (Element 3)

material	SF6
process	conventional polish
edge	fine ground
surface finish	40-20
surface roughness	<100 Ang.
edge bevel	45 deg
index of refraction tolerance	+/- 0.001
radius 1	-64.39 +/- 1.0
radius 2	70.49 +/- 1.0
wavefront aberration- power	<1 fringe @ 632 nm
wavefront aberration- irregularity	<1/4 fringe @ 632 nm
clear aperture diameter	40.0
edge diameter	44.0, -0.025 +0.0
central thickness	10.0, +/-0.5
wedge	<0.040 TIR



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3.1.1.4 Antireflection Coating

Applied to both surfaces of all three elements

coating efficiency	>99.5 % transmissivity per surface
operating wavelength	1064 nm
Incidence angle	Normal
Durability	MIL-C-675C

3.2. Optical design

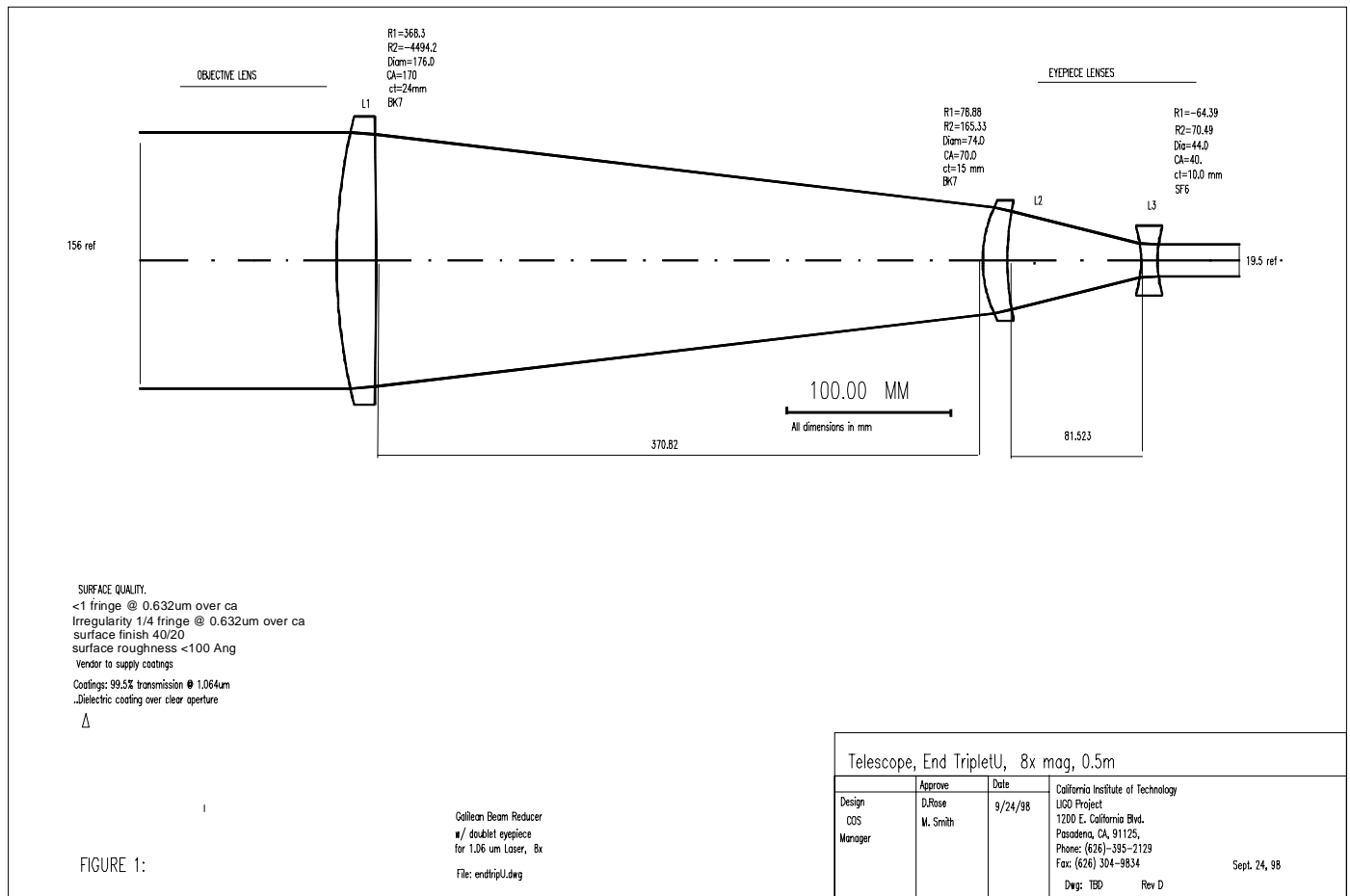


FIGURE 1:

Figure 1: ETM Telescope, optical layout



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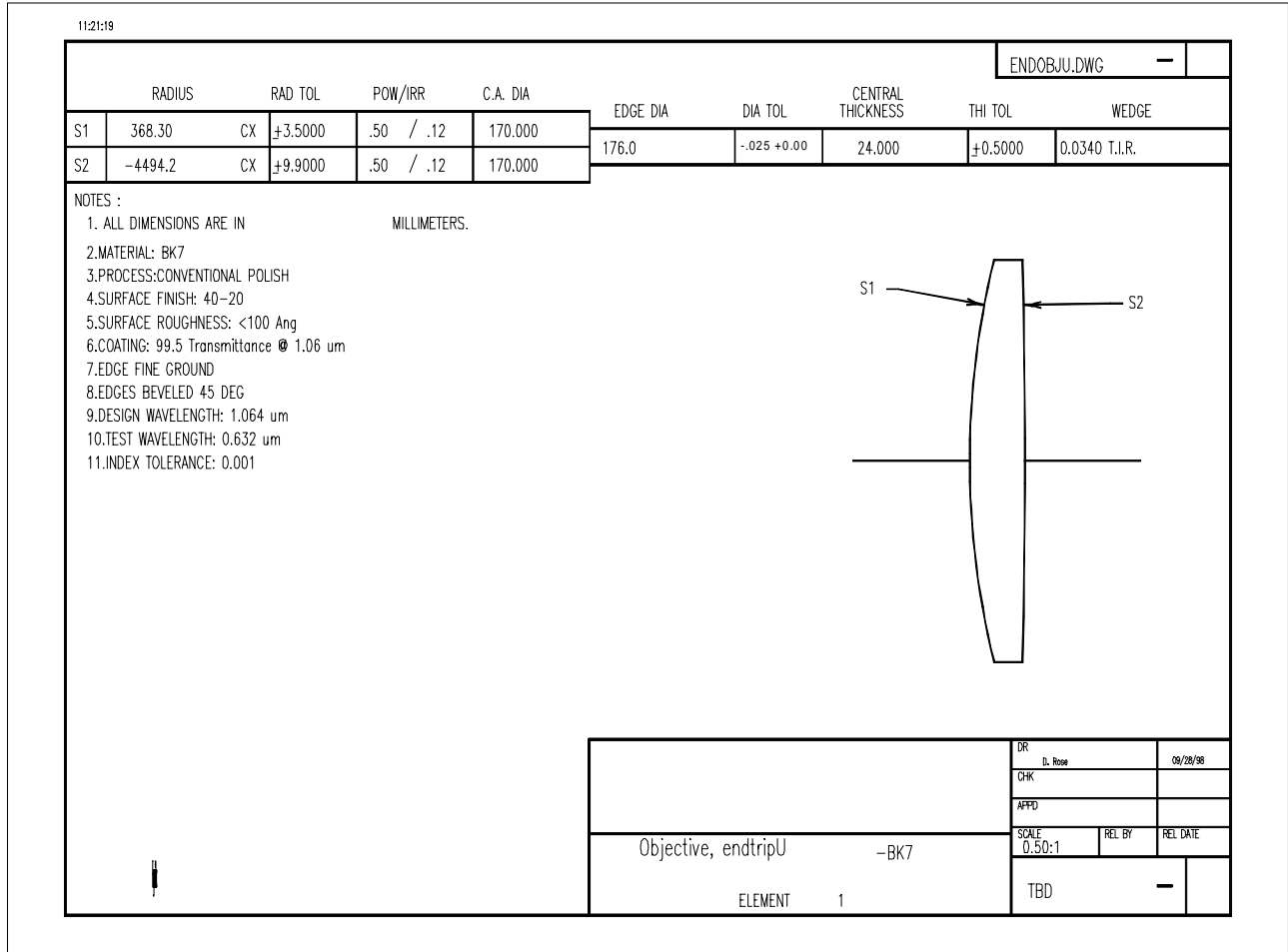


Figure 2: Objective lens (Element 1), ETM telescope



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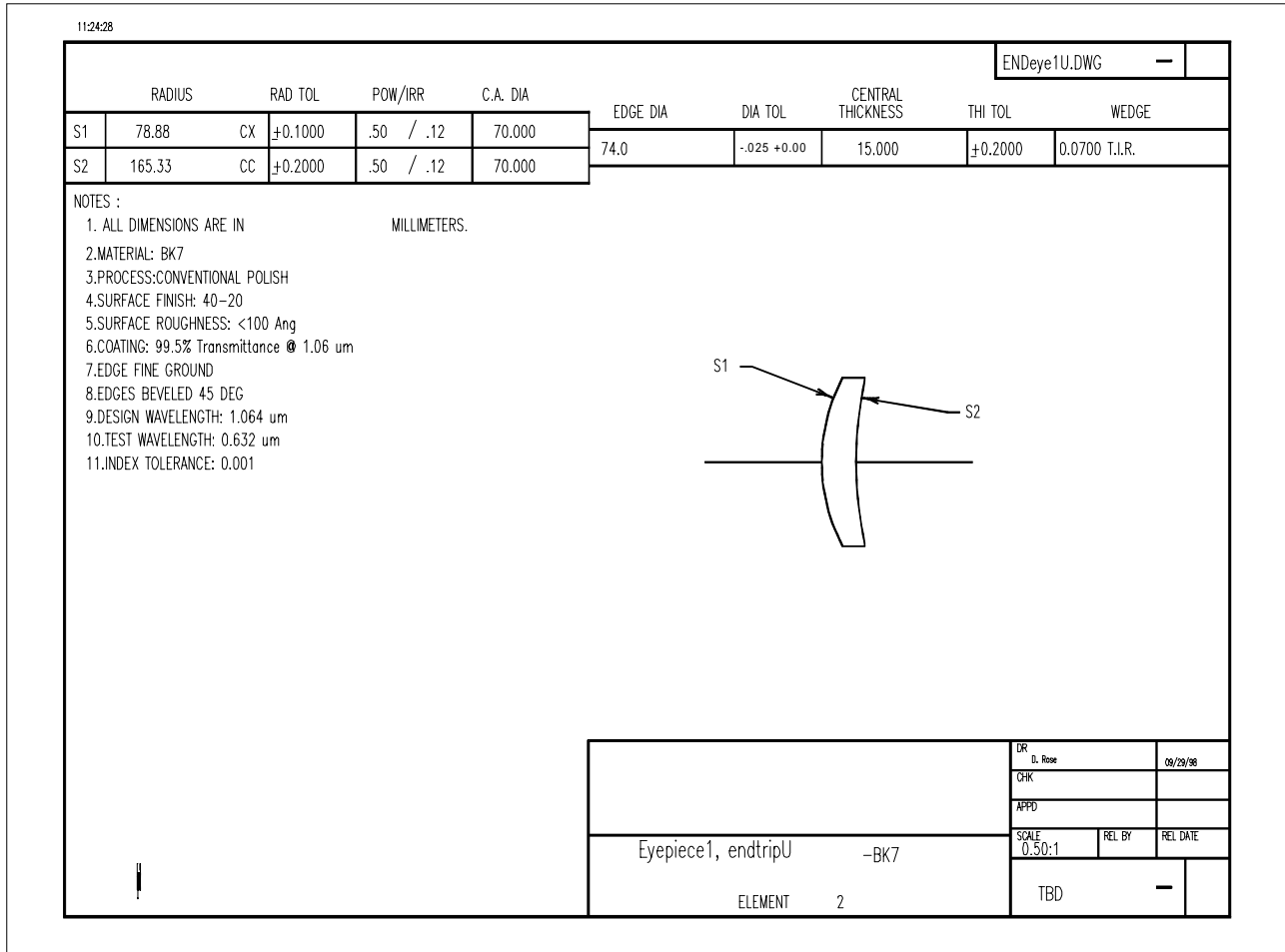


Figure 3: Eyepiece 1 lens (Element 2), ETM telescope



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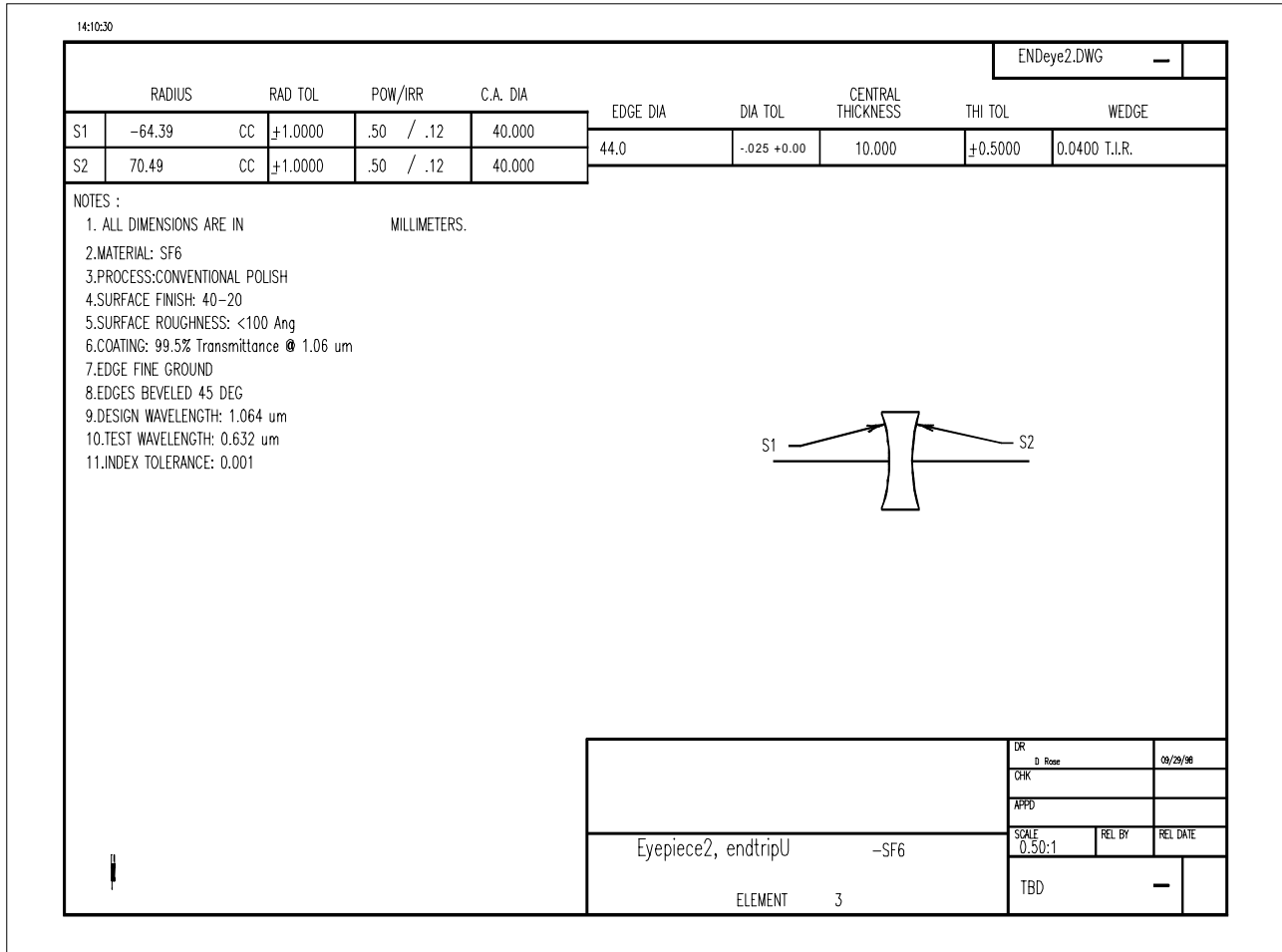


Figure 4: Eyepiece 2 lens (Element 3), ETM telescope



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3.3. Quality Assurance/Control

3.3.1. Serial Number

3.3.1.1 Optical Serial Number

A serial number identifying a component set of elements shall be etched, ground or sandblasted on the edge of each element.

3.3.1.1.1 Serial Number Format

The Serial number shall be of the format: E980328-y S/N *e-nnn*, where E980328-y is the LIGO specification number, E980328, including the revision letter, -y, to which the hardware item was built; *nnn* is the sequential serial number, 001 through 999, in the order produced, and *e*=1, 2 or 3 describes the objective (*e*=1), eyepiece 1 lens (*e*=2) or eyepiece 2 lens (*e*=3)

3.3.2. Quality Assurance Provisions

A first article shall be produced and inspected for form, dimensions and workmanship.

3.3.3. Purchaser Access

Non-escort privileges for the buyer, owner, government and owner representatives to all areas of the facilities where work is being performed shall be arranged. This will include access to all areas where material is being processed and stored. The purchaser shall have the right to witness all manufacturing processes.

3.3.4. QA Approval

LIGO QA reserves the right to inspect and approve vendor/fabricator QA plan and processes.

4 TEST PROCEDURES

The lenses' performance shall be verified by the following test procedures

4.1. WAVEFRONT DISTORTION

Interferogram of transmitted wavefront across clear aperture, @1064nm wavelength

5 DOCUMENTATION

- 1) Compliance Certification for items 3.1., 3.3., 4.



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- 2) Interferogram,

6 ENVIRONMENTAL CHARACTERISTICS

The ETM Telescope will operate in a non-vibrational, ultra high vacuum environment, at room temperature (68F,+/-4F).

7 HANDLING AND SHIPPING PROCEDURES

7.1. Cleaning

Approved cleaning procedures for UHV components are detailed in LIGO-E960022, Vacuum Compatibility, Cleaning Methods and Compatibility Procedures.

7.1.1. Optical Surfaces

All optical surfaces shall be cleaned in accordance with good commercial practice. Nothing shall contact the optical surfaces after cleaning, except for lint-free lens tissue.

7.2. Packaging for Shipment

7.2.1. Optical Parts

The cleaned optical components shall be protected with lint-free lens tissue. In addition, all components shall be placed in a sealed, clean polyethylene bag before shipping. Shipping containers must ensure that the bag does not get punctured and that the parts are properly protected during transit.